NATO STANDARD

AMSP-05

HANDBOOK (BEST PRACTICE) FOR COMPUTER ASSISTED EXERCISES (CAX)

Edition A Version 1
AUGUST 2018

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED MODELLING AND SIMULATION PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

27 August 2018

1. The enclosed Allied Modelling and Simulation Publication AMSP-05, Edition A, Version 1 HANDBOOK (BEST PRACTICE) FOR COMPUTER ASSISTED EXERCISES (CAX), which has been approved by the nations in the NATO MODELLING AND SIMULATION GROUP, is promulgated herewith. The recommendation of nations to use this publication is recorded in STANREC 4801.

2. AMSP-05, Edition A, Version 1 is effective upon receipt.

3.

4. This publication shall be handled in accordance with C-M(2002)60.

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

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PREFACE

The MSG-086, MSG-105 and finally the MSG-106 overall vision throughout was and is to deliver to NATO and Partners a persistent, distributed combined joint training capability able to support training from the operational to the tactical level across the full spectrum of operations, by leveraging existing national expertise and capabilities. This resulted in products like e.g. SNOW LEOPARD, NETN (NETN FOM) and DTE.

With the MSG-106 “SPHINX” not just the continuing development of technical products but the further development of the AMSP-03 have been in the focus but also the development of a Handbook which is supposed to support the operational personnel to plan a distributed CAX utilizing simulation.

The aim is to provide additional guidelines to operational personnel who refer to the BI-SC 75-3 ANNEX N for their CAX utilizing simulation planning. It provides a “roadmap” for considerations:

a. What information is required to plan, execute, analyse and report the results of the exercise; and

b. What are the information exchange requirements between the different stakeholders throughout the whole Exercise process.

Emphasis has been laid on providing guidelines to operational personnel on how to plan a CAX using simulation.

This Handbook should increase the operational personnel’s awareness of special requirements and demands from the supporting technical personnel. Furthermore the necessary feedback from the technical side towards the operational planning process that should be provided has been identified.

The following publications provided necessary standards and important inputs for the development of this Handbook:

a. “A Procedure Model for Distributed Simulation”, VEVA Handbook (developed for the German Procurement Office by the German Armed Forces University Munich and the ITIS GmbH);

b. NATO Bi-SC Collective Training and Exercise Directive 75-3, Edition 2013;

c. “A Multi-Faceted Approach to the Development of the HLA 1516-2010 German Maritime Federation Object Model (GMF)”, by the German Navy Modeling and Simulation Commissary;

d. “Computer Assisted Exercises and Training, A Reference Guide”; by Erdal Çayirci and Dusan Marincic; and

e. “Exercise White Book, Guidelines for Comprehensive Civilian-Military-Police Exercises”, by David Lightburn for the Folke Bernadotte Academy.

Experiences made during the planning of various different exercises like for example the VIKING EXERCISES (SWE) or the NetOpFueEXER (DEU) supported the process to cross-reference this theoretical approach with real life exercise planning. Furthermore the knowledge and experiences from different commands and institutions (e.g. Joint Force Training Centre, NATO M&S centre of Excellence, German Navy Headquarters Methodology Branch) were considered and incorporated.

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CHAPTER 1 INTRODUCTION

1.1. MOTIVATION AND STARTING POINT

1. When constructive simulation is used in exercises (CAX) it has to produce high-quality results. This means – among other things – that the results have to be robust, traceable and reproducible. In light of the fact that distributed exercises and distributed simulations are even more complex projects with a large number of different actors involved, a standardized and practice-oriented procedure model for planning and execution is an important means to achieve these objectives.

2. It was noted that no standardized and practice-oriented procedure model is available for the operational personnel to receive proper support by the technical community to plan and execute a CAX. Therefore MSG-106 "SPHINX" developed this Handbook to provide a generic process that enables the operational planners to communicate their CAX requirements.

3. This Handbook provides guidelines primarily to operations personnel on what to consider during the planning/development process and what interaction and information requirements to other contributors are required to achieve success. Furthermore it outlines the entire planning, development and execution process of possibly distributed CAX. It does not serve all participants included in the planning and development process.

1.2. ADVICE ON HOW THIS HANDBOOK SHOULD BE USED

1. This section is intended to provide a guideline for preparing and carrying out a (possibly distributed) CAX.

2. Therefore, readers are recommended to use this Handbook as follows.

1.2.1. General Remarks on the Application of this Handbook

The Handbook is designed to provide support in planning, preparing and executing a (possibly distributed) CAX utilizing simulation in such a way that it yields high-quality results. It is not the aim of the Handbook to produce a maximum of documentation just for the sake of documentation. The guidance on documentation should rather be understood as advice on which aspects should be taken into consideration in planning and executing a distributed simulation. At the same time it is designed to ensure that all relevant aspects are in fact taken into account. Of course these aspects should additionally be laid down in written form (i.e. documented) in order to avoid misunderstandings and ensure transparency and conclusiveness.

1.2.2. Type and Scope of the Documentation

In principle all documentation aspects should be prepared in accordance with the Handbook. Depending on type and specific requirements of the CAX, scope and detail of the single aspects of the documentation can be adjusted.

1.2.3. Sequence of Modules and Steps

The modules and steps defined in this Handbook build upon each other and, accordingly, they depend on each other. Every user should try to stick to the given sequence of modules. Peculiarities of specific projects often require returning to earlier phases. Also, the circumstances related to personnel and time resources often require the work to be done in parallel on several modules. Again, in the end the decision on how strictly to follow the Handbook is up to the person in charge of the respective CAX. The sequence of the steps (i.e. of the activities within a module) defined by the Handbook should be understood as a recommendation as to what working sequence is reasonable. However, practical considerations often make the simultaneous work on several steps an adequate approach.

1.3. OVERVIEW

1. This Handbook was designed to complement and augment the Bi-SC 75-3 “Collective Training and Exercise Directive” with regard to the planning of CAX. The foundation of the seven modules of this Handbook is laid in the Bi-SC 75-3 with its description of the four stages of the NATO Exercise Process:

   a. Concept and Specification Development;

   b. Planning and Product Development;

   c. Operational Conduct; and

   d. Analysis and Reporting.

2. The seven modules of this Handbook are linked to these four stages as depicted in Table 1-1.

Table 1-1: The Modules of the Handbook.

BI-SC 75-3	HANDBOOK
1. Concept and Specification Development	Module 1: Goal Definition Module 2: Conceptual Planning
2. Planning and Product Development	Module 3: System Dependent Planning Module 4: Execution Preparation
3. Operational Conduct	Module 5: Execution
4. Analysis and Reporting	Module 6: Analysis Module 7: Follow-Up

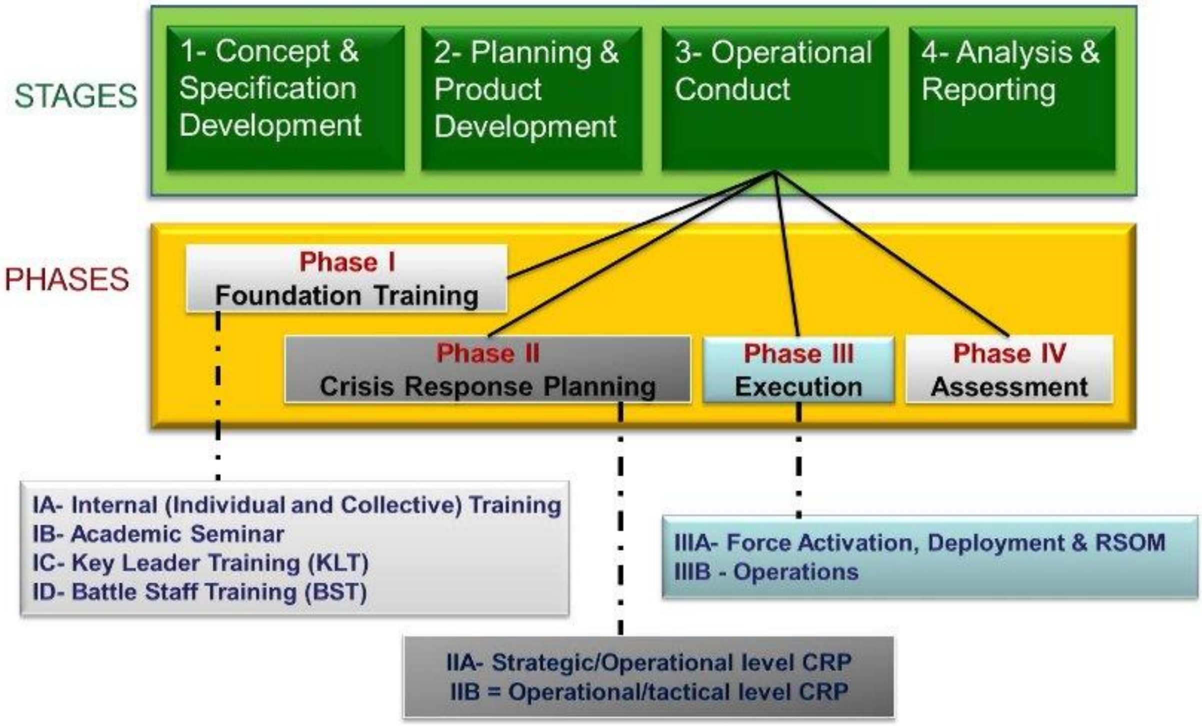

Figure 1-1: Bi-SC 75-3 / NATO Exercise Process: Stages and Phases.

3. The Handbook's 7 Modules are further broken down into several easy to handle steps. The process' sequence is iterative, which means that going back and forth within the process is possible and may even be necessary. In addition, this Handbook includes a role concept that represents all actors involved in a CAX and outlines their duties and responsibilities.

4. While the seven Modules are matched to the four stages of the NATO Exercise Process, the Module-defining-steps are bridging these towards the IEEE Recommended Practice (IEEE 1730) Distributed Simulation Engineering and Execution Process (DSEEP).

Table 1-2: NATO Exercise Process Stages and Handbook Modules vs. DSEEP Process.

BI-SC 75-3 Stages	Modules	Steps	DSEEP Process
1	Module 1 Goal Definition	1) Problem Identification 2) Requirement Specification	1
1	Module 2 Conceptual Planning	1) Scenario Modelling 2) Capability Analysis 3) Realisation Types	2
2	Module 3 System Dependent Planning	1) System Selection 2) Simulation Environment Preparation 3) Feasibility Check	3 4 5
2	Module 4 Execution Preparation	1) Execution Planning 2) Structure Planning 3) Implementation 4) Setup Testing and Integration	6
3	Module 5 Execution	1) Simulation Execution 2) Reconfiguration	6
4	Module 6 Analysis	1) Data Preparation 2) Plausibility Check 3) Analysis and Interpretation	7
4	Module 7 Follow-Up	1) Evaluation 2) Identification of Reusable Components 3) Termination	7

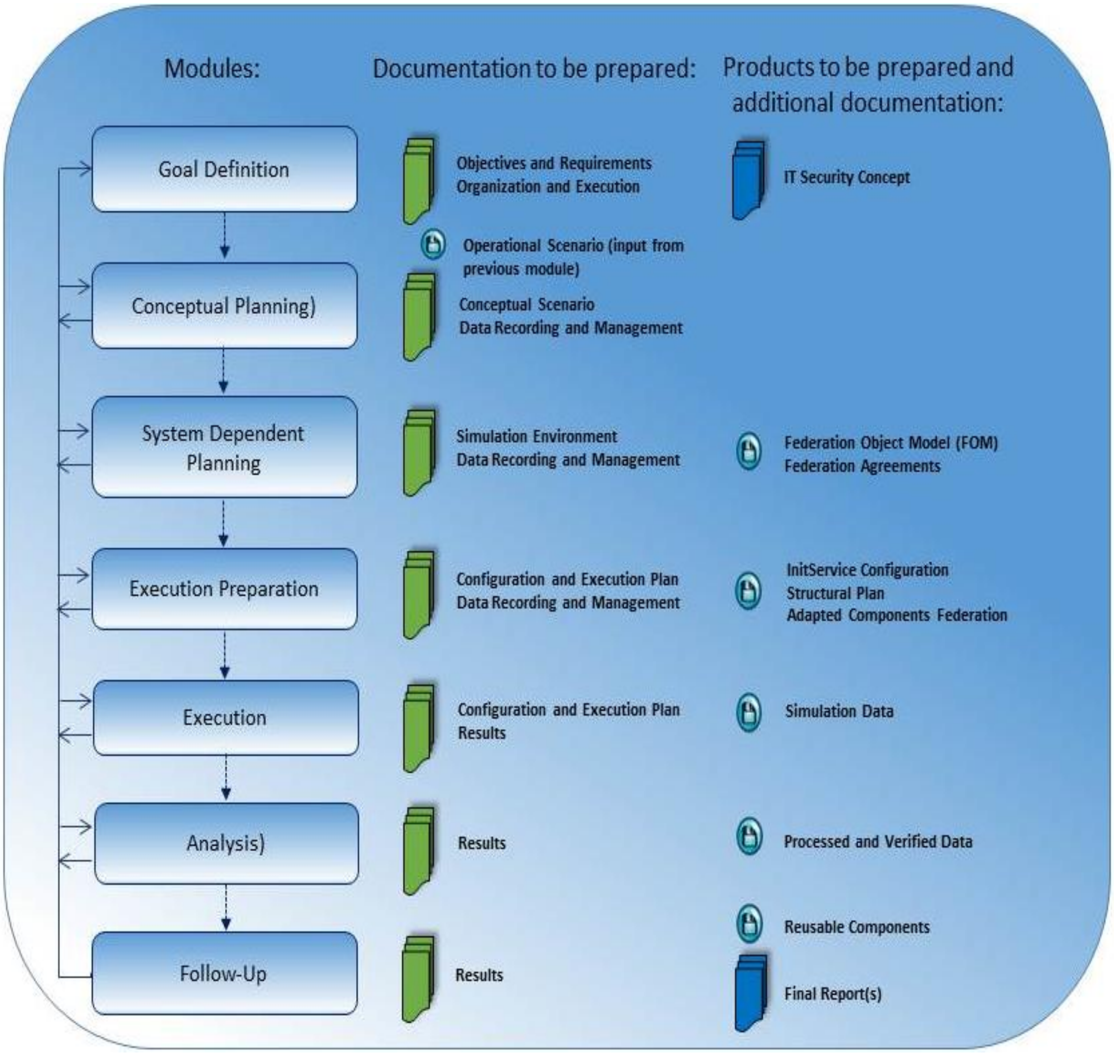

Figure 1-2: Introduction: Overview.

1.4. ROLE CONCEPT

An application of the procedure model involves highly different activities that may require highly different specialist's knowledge, which means that usually these activities have to be performed by different persons. All activities to be carried out within these guidelines are assigned to certain roles. Therefore, the roles stand for fields of expertise that have to be covered in the course of the CAX. Rather than being tied to specific persons the roles may be performed by whole branches of organizations. It is also possible that a single person or organizational entity performs several roles. Therefore, this document uses neutral role designations that do not imply a reference to single persons. The roles used in this Handbook are:

a. Analysis;

b. Subject Matter Expert (SME) in specific topics;

c. Officer Conducting the Exercise (OCE);

d. Configuration Management;

e. Quality Management;

f. Security Management;

g. Modelling;

h. Operator Personnel; and

i. M&S Administration.

CHAPTER 2 MODULE 1: GOAL DEFINITION

1. Within the military environment any exercise is usually conducted on order of the Officer Scheduling the Exercise (OSE). Commonly the participants can be identified within this order or in case of an “Invitation Exercise” upon the response of the invited training audience. However, during the Initial Planning Conference the participants should be identified. Given Exercise aim, main objectives, and the training audience’s training requirements are the exercise defining parameters for the exercise design.

2. The Goal Definition (Figure 2-1) is the first module of the Concept and Specification Development stage (Bi-SC Directive 75-3). Based on the Exercise aim and main objectives given by the OSE (Officer Scheduling the Exercise), the OCE (Officer Conducting the Exercise) then derives the training objectives from the Training audience and orchestrates them to achieve the OSE aim and training objectives.

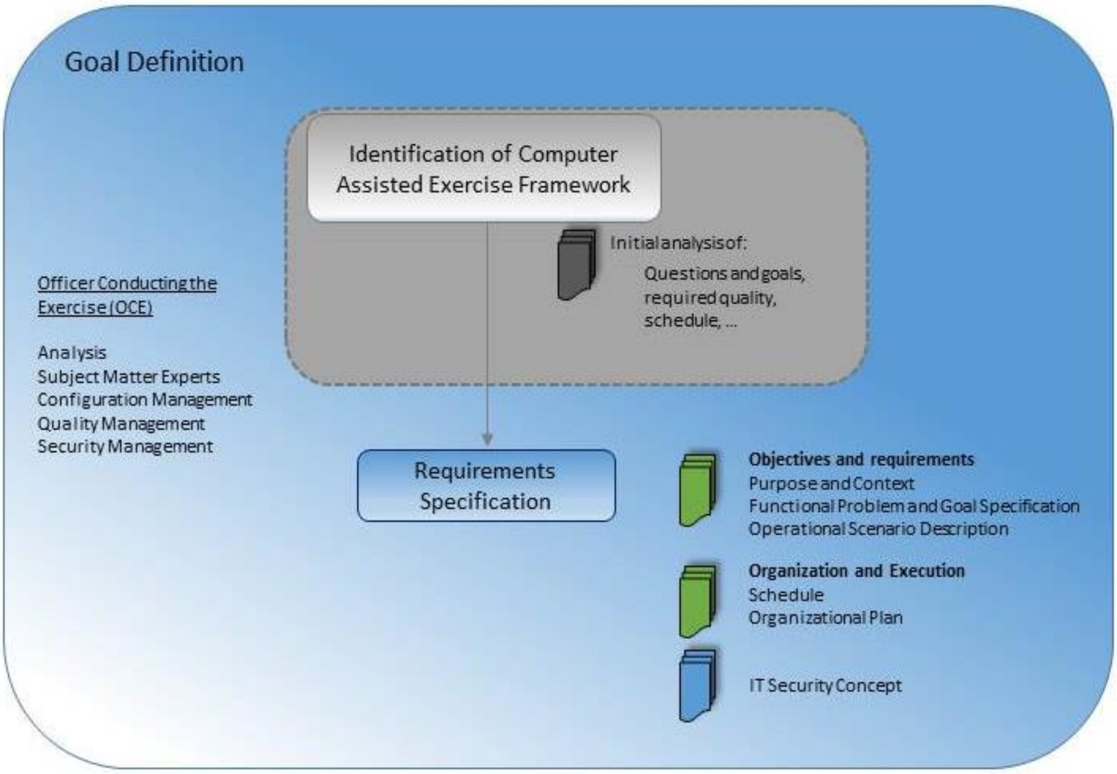

Figure 2-1: Module 1: Goal Definition.

3. This module determines the requirements placed on the Computer Assisted Exercise and the distributed simulation and specifies them in more detail, afterwards. It comprises the steps Problem Identification and Requirements Specification.

4. The importance of this module can hardly be over-estimated. All relevant requirements placed on the Exercise and on the operational and technical requirements of the Exercise are determined at this time.

5. The documentation prepared in the course of this modularised work is to define intermediate goals for all work to follow, i.e. for all further activities within the process. This immense importance implies, in turn, that particular attention to this first phase is imperative and that it should be carried out very thoroughly.

2.1. PROBLEM IDENTIFICATION

1. Problem Identification forms the start of every Exercise and stands for the fact that the need for a Computer Assistance including distributed simulation has been identified by the OCE. The issue here may be to test a system within an integrated network or to find an answer to a specific question by means of simulation.

2. The questions to be answered and the goals to be achieved are usually laid down in an unstructured form. What is frequently done at this time already – apart from defining the actual question(s) – is to identify initial constraints and acceptance criteria, possibly also guidelines on systems that have to be used.

3. The Problem Identification step is likely initiated by persons being part of the Exercise.

4. Apart from the actual operational objectives of the Exercise the aim is to document the requirements placed on the quality of the results as precisely as possible, since they are crucial for Verification, Validation and Accreditation (VV&A) of the Exercise.

5. Moreover, the aim is to choose the country book and to describe the operational scenario to be simulated as precisely as possible at that early time. In addition, this step is to develop an initial version of the schedule, which contains a timeframe with milestones.

2.1.1. Activities

a. Analysis of the goals, aim and main objectives to be achieved with the Exercise;

b. Identification of the available resources;

c. Determination of main constraints; and

d. Initial development of a possible operational scenario.

2.2. REQUIREMENTS SPECIFICATIONS

2.2.1. Description

1. In the course of the Requirements Specification, the Exercise, which has so far only been defined in outline, is specified in detail. The Requirements Specification is the starting point of the entire process. The responsible Subject Matter Expert (SME) (hereafter represented by the role OCE) is expected to define the objectives and all requirements of the planned Exercise, in this step. The OCE is supported by other roles as necessary.

2. The Analysis role helps in the determination of potential measuring values, target values and of the variable input data.

3. The Quality Management role ensures the adequate description and definition of quality criteria. The operational scenario description is specified in cooperation with Domain Expertise. If necessary, the simulated objects with their alternative courses of action and the scenario with its separate stages are added.

4. When the OCE has decided to use the process of this handbook, the planning is complemented by determining a schedule for the phases and steps. This step is of crucial importance for the whole Exercise and should therefore be carried out with extreme diligence.

5. Since all ensuing activities in the course of the Exercise build on the requirements and fundamentals documented during this step, any carelessness or quality deficiency in the work at this stage has a direct negative impact on the entire Exercise as well as on the quality of the final simulation results. Experience has shown that an additional initial effort during this step will be more than compensated by effort savings and a smooth proceeding at a later time.

6. Note: The objectives for an Exercise should be defined as precisely as possible; in particular a strong focusing on the aim of the Exercise is expedient.

7. Reminder: The operational scenario is defined as the set of data provided by the modules 5 and 6 which includes MEL/MIL. The country book is composed out of the modules 1, 2, 3, and 4.

2.2.2. Activities

a. Analysis of the information available so far from the Problem Identification (OCE);

b. Determination of variable input values (OCE, Analysis);

c. Determination of measuring and target values (OCE, Analysis);

d. Specification of quality requirements (OCE, Quality Management);

e. Preparation of operational scenario description and country book (OCE, Domain Expertise);

f. Analysis of potentially security-relevant aspects (OCE, Security Management); and

g. Preparation of schedule and organizational plan (OCE).

2.2.3. Documentation to be Prepared

a. Objectives and Requirements.

b. Purpose and Context.

c. Functional Problem and Goal Specification.

d. Country book (module 1, 2, 3, 4).

e. Operational Scenario Description (module 5, 6).

f. Organization and Execution.

(1) Schedule; and

(2) Organizational Plan.

2.2.4. Products to be Prepared and Additional Documentation

a. IT Security Concept.

CHAPTER 3 MODULE 2: CONCEPT PLANNING

3.1. REQUIREMENTS SPECIFICATIONS

1. The Conceptual Planning module (Figure 3-1) is the second module of the Concept and Specification Development stage (Bi-SC Directive 75-3). The objectives and requirements defined before are used for developing a Conceptual Planning Model.

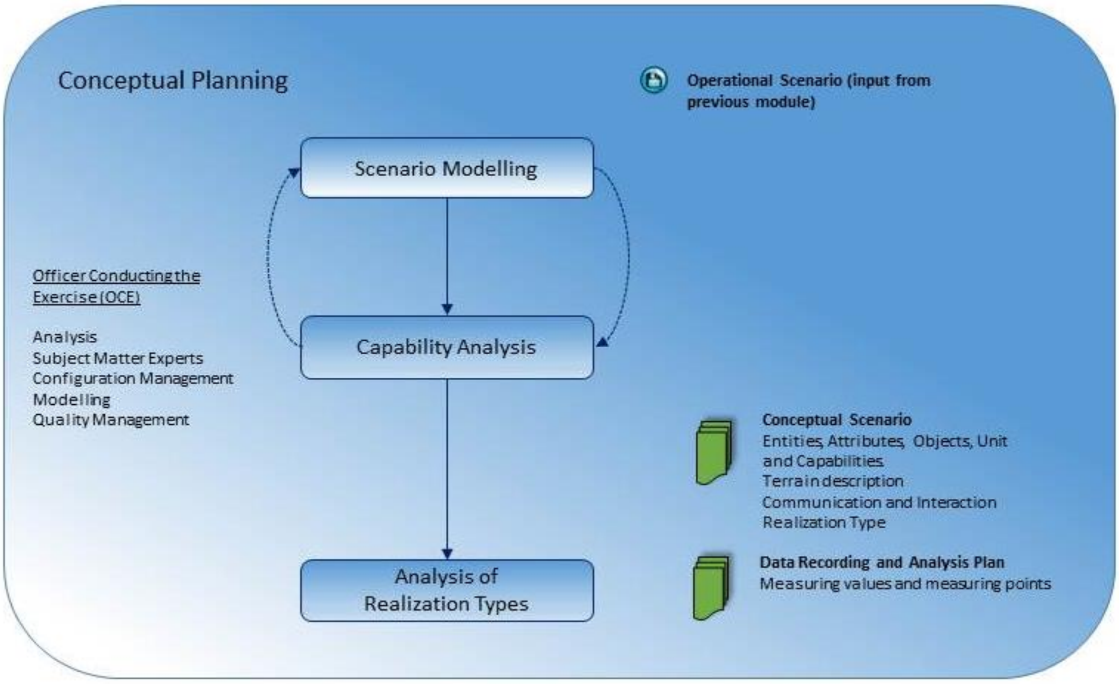

Figure 3-1: Module 2: Conceptual Planning.

2. The Conceptual Planning Module is a system-independent modelling that contains all aspects of relevance for the exercise. It covers, on the one hand, the detailed modelling of the operational scenario and, on the other hand, a detailed description of all entities, units, attributes (part of conceptual scenario and included in country book if needed) and objects that are part of the simulation (executable scenario). This requires that besides the characteristics and capabilities of the entities, units, attributes and objects, the various relations and interactions between the entities, units, attributes and objects have to be modelled, too. This Modelling Process results in the conceptual scenario.

3. Two major benefits are resulting out of the conceptual planning: understanding and reusability.

3.1.1. Understanding

1. Preparing a conceptual planning model obviously requires a deep understanding of the domain and the objectives and the requirements. Whereas the requirements specification of phase 1 was primarily conducted by the OCE (i.e. the respective Subject Matter Expert), module 2 now brings a change of design lead. Instead of the OCE it is now the modelling experts and (somewhat later) the simulation experts that execute the leading function. Transferring the objectives and requirements into a conceptual planning model makes it possible for all actors involved (who may not be on the same level of experience and knowledge) to gain a common understanding of the exercise and the requirements placed on it.

2. Example:

SPHINX conceptual planning model applied to VIKING-2014

Glossary	Activity summary	
Activité	[254] VIKING_2014	
Activity database	INT	
CAX, EXP or DEM	CAX	
Classification	UNCLASSIFIED	
Beginning date (aaaa-mm-jj)	2014-03-31	
End date (aaaa-mm-jj)	2014-04-10	
Calendar		calendar VIKING-2014_TECH-timeline.jpg VIKING-2014_exercise-schedule.jpg VIKING-2014_timeline.jpg
Pilots (scheduler and commander) 20140604_BiSC-75-3_responsabilities-in-TOD-process.jpg	OCE : Swedish Armed Forces / Carl Frederik KLEMAN carl-fredrik.kleman@mil.se	pilot 20140330_VIKING-2014_EXPLAN1.4-U-joasva03.pdf
Activity description 20140205_countryBook.odt 20140205_countryBook.pdf	> 7th VIKING Exercise : 2 500 participants (15 % civilian), 50 + countries, 90 + organizations, 8 exercise sites > Exercise VIKING is a training platform designed to prepare civilians, military and police together for deployment to a peace or crisis response mission area. > Developed and implemented in "the Spirit of NATO's Partnership for Peace'	activityDescription VIKING-2014_introduction-to-VIKING-14.pdf cax_description-overview.jpg

Activity type 20140930_exerciseTypes.odt 20140930_exerciseTypes.pdf	> A distributed computer-assisted (CAX) command post exercise (CPX) co-chaired by Swedish Armed Forces and the Folke Bernadotte Academy supported by a large number of partner nations and organisations. > The exercise is multidimensional, multifunctional and multinational, with an emphasis on realism and current operational concepts.	
Activity aim	The aim of VIKING 14 is to train and educate participants - civilian, military and police - to meet the challenges of current and future multidimensional crisis response and peace operations. This includes planning and conducting a UN mandated Chapter VII peace operation in an unstable environment and based on a comprehensive approach, focusing on co-operation and co-ordination with all relevant actors, understanding their interdependencies and relations	
Activity objectives	(not in priority order) > Understand and apply a comprehensive approach to international peace operations, including the role of the host nation. > Promote mutual understanding, confidence, co-operation and interoperability among all contributing and affected forces, organisations, offices and personnel. > Understand and apply mission command/management, staff roles and functions, procedures and structures and co-ordinated planning processes. > Understand and apply current operational concepts reflecting present and future challenges in international peace operations	

Audience objectives OPS operational_objectives.odt operational_objectives.pdf	A. Understand and apply the interdependencies, roles and responsibilities of various contributors to a multidimensional peace operation. B. Conduct organisational tasks and activities in line with mission plans and mandates. C. Conduct effective and appropriate interaction, coordination and cooperation between all relevant actors including the host nation, in line with mission plans and mandates. D. Develop and implement effective and appropriate mechanisms for sharing information between all relevant actors, including the host nation. E. Conduct medium term planning, coordinated with relevant actors. F. Conduct long term planning, coordinated with relevant actors. G. Develop a shared situational awareness and, where appropriate, conduct common assessments of the mission area. H. Apply current concepts and methods related to peace operations and practice organisational Standing Operating Procedures. I. Apply relevant international, regional and local conventions, laws, declarations, resolutions, agreements and guidelines. J. Practice civil-military coordination activities with respect to humanitarian law and principles. ... and sub training objectives...	CUSTOMER 20140530_VIKING-2014_training-objectives.odt 20140530_VIKING-2014_training-objectives.pdf operational-scenario training-audience-organisation-development.jpg

Activity organization 20101027_PIA_7-3_montexia.pdf 20140604_BiSC-75-3_JWC-EXCON-model.jpg 20140604_creation-of-database.jpg GOV MP-MSG-045-01.pdf bi-sc 75-3_28-10-2010.pdf bi-sc-75-3_02-10-2013.pdf		USER conceptual-scenario exercise-data viking-2014-vignettes.jpg viking-2014_exercice-control-structure.jpg
Federation design 20140604_BiSC-75-3_JTLS-database-requirements.jpg 20140604_BiSC-75-3_JWC-EXCON-model.jpg MP-MSG-060-02.ppt federation_description.pdf	Country book : https://portal.ledss.mil.se/sites/viking14/vww/CrisisWeb/default.aspx	federationDesign VIKING-2014_CAXCCIS-in-VIKING-14.pdf

Stakeholders and means involved in the exercise

Training or Experimented audience	Training or experimenting centres	Reference architectures
LCC	SE_ACTS	L16
MCC	SE_CCR	HLA 1516 EVOLVED
CAOC	SE_LGR	Standalone
BFOR HQ	SE_NWC	NFFI
ACC	RS_Serbie_Centre	MIP
Bde HQ	BG_Bulgaria	HTTP
NTG	GE_Georgia Centre	HTTPS
UNMIB HQ	IE_Ireland Centre	TCP/IP
DSRSG Political		
DSRSG RC/HC		
UN Police		
UN Military		
UN Country Team		
Regional Office		
Sector HQ - UN		
Country Office		
Regional Office - UN		
EUCAM HQ		
EUBG (F) HQ		

Interface data					
Missions and operations	Information products	Control cells	Activity data	Software applications	Technical equipments
Chapter VII peace operation		DIREX	MELMIL	ICC	CAXCON
		Senior Mentors	ODB	VBS2	CISCON
		EXEVAL	Buildings	ARMOR	PIC
		Command Group	Data organizations	VTC system Polycom	RLS
		JEC	Geodata	Lignes téléphoniques commerciales	Security
		OTTM	Map layers	NIRIS	VOB
		JEC Current Cell	Relational schedule	JCATS	
		JEC Plan Cell	Target list	EXONAUT	
				TYR	
				Sitaware	
				Passerelle SIMU-Sitaware	
				FT	
				Portail Web	
				Internet Protocol (IP) Phones	

Interface		
Vignettes or tasks	Country books	Services
Safe & Secure Environment	BOGALAND Crisis WEB	Publication d'annonces
Protection of Civilians		Courrier électronique
Air Space Control		VTC
Irregular Forces		Exercise Management Service
Gender		VoIP
IDP´s & Refugees		Simulation CGF
Maritime Security		COP
Cooperation & Coordination		Fax
Rule of Law		Téléphone
Humanitarian Assistance		Document management service
Human Rights		Réseau - Internet
Statebuilding		Réseau - Internet VPN-tunnel
		Réseau - LAN d'organisation
		Simulation voice communication
		Suite de logiciels bureautiques
		Calendrier partagé
		Chat
		CTP
		Power Availability

3.1.2. Reusability

1. The conceptual planning model is a system-independent modelling of the domain resulting from the objectives and requirements. It does not say anything about the technical realisation.

2. This means it is possible to realise a certain conceptual planning model in different technical ways. As a consequence, it is not necessary to carry out the first two modules (Goal Definition, Conceptual Planning) one more time. Hence for repetition of a similar exercise the planning process can start directly at the beginning of module 3

(System- Dependent Planning). This can be the case if the same task is to be repeated using other or newer simulation functionalities.

3. That's the reason why the notion of the "country book" has been created. The country book is the reusable part of the Bi-SC 75-3 scenario (modules 1, 2, 3 and 4).

4. Besides the option of complete reusability of the conceptual planning model it is also possible to re-use only certain parts of it. This is a useful option whenever a new task or question differs from a preceding one in certain aspects only.

5. Without a conceptual planning model any assessment of the reusability of a preceding exercise is based exclusively on the objectives and requirements and on the technical realisation. While the objectives and requirements are in many cases not described detailed enough for such an assessment, the pragmatics of past exercises cannot be derived from the technical realisation. (SPHINX conceptual planning model provides detailed description from past exercises) The conceptual planning model serves as the necessary tool for a well-founded assessment of the reusability.

3.2. CONCEPTUAL SCENARIO MODELLING

3.2.1. Description

The task for the conceptual Scenario Modelling is to create a detailed model of the operational Scenario, which has so far only been described in operational terms. Whereas in the course of the Requirements Specification the selected operational scenario was described from the point of view of the subject matter experts, the scenario is now modelled in detail with regard to training aspects.

3.2.2. Activities

a. Analysis of the information from Requirements Specification (OCE); and

b. Modelling of the scenarios (Modelling, Subject Matter Experts).

3.2.3. Documentation to be Prepared

Conceptual Model (see AMSP-03 for definition) – The Conceptual Model provides a non-technical description of Entities, Units, Objects and their capabilities and interactions. A formal description of the Conceptual Model is desirable for various reasons. So far, however, no standards or established description formats exist for this purpose.

3.2.4. Products to be Prepared and Additional Documentation

Conceptual Scenario (see AMSP-03 for definition) – If there is a standard for the formal description of scenarios available, the scenario should be modelled using this format.

3.3. CAPABILITY ANALYSIS

3.3.1. Description

1. Based on the Exercise/Training Objectives and the operational scenario, and the country book, it is now possible to derive the capabilities that the modelled units and objects have to meet. That's the conceptual scenario. Above all the Capability Analysis has to take the following aspects into account:

   a. Capability requirements;

   b. Communication relationships; and

   c. Effect and interaction relationships.

2. The analysis of the capability requirements covers the necessary characteristics of the entities, attributes, units, and objects of the conceptual scenario. Examples are the terrain mobility conditions for units or the ways in which they can become damaged.

3. Once the entities, attributes, units, and objects involved and their characteristics have been determined, the communication and interaction relationships have to be modelled. Generally, the communication relationships of the units have to be considered on two levels, the scenario level (conceptual scenario) and the system level (executable scenario). However, in the context of the Conceptual Model it is only the scenario level that is of relevance.

4. The central question that has to be answered here is: Which entities, units, and objects of the scenario communicate with which other entities, units, and objects and what data they are using?

5. The crucial point is to define what data is exchanged between certain entities, units, and objects and for what purpose. The formatting and the concrete exchange method, however, are issues remaining open at this point.

6. The Effect and Interaction relationships cover the whole potential of scenario units and entities to exert an influence on another unit, entity, object or the environment. From the theoretical point of view, the Effect relationships are a subset of the Interaction relationships.

7. Given their outstanding significance in the military context, however, the Effect relationships require special attention. Effect relationships cover all direct and indirect fire and should therefore be considered separately from the other potential Interaction relationships, i.e. civilians with police etc. Just like the communication relationships the Effect relationships should be modelled in as much detail as possible. Any other interaction between entities, units, and objects are assigned to the Interaction relationships. One way of documenting the communication, Effect and Interaction relationships is to use matrixes.

8. Based on the detailed operational scenario requirements units, entities and objects must now be modelled. Furthermore the determined target values need to be verified according to the Requirement Specification and translated into measuring values if required. In the simplest possible case the target values have been already described

in sufficient detail and can be copied and pasted as measuring values without any changes. If this is not the case, the target values have to be refined accordingly.

9. For example, there are target values which describe a certain duration (e.g. “time from reconnaissance of an enemy object until engagement”). On the basis of modelled scenarios those target values have to be translated into more detailed measuring values (e.g. “time from reconnaissance of object X (e.g. Radar Site) until engagement of the object by unit Y (e.g. Interceptor)”).

10. The measuring values defined in this context must be unambiguous and must be measurable. It is particularly important to eliminate potential ambiguities or inaccuracies in translating target values into measuring values.

3.3.2. Activities

a. Analysis of the operational scenarios and country book (Modelling, Subject Matter Expert);

b. Modelling of the capability requirements (Modelling, Subject Matter Expert);

c. If necessary, depiction of variable entry values in capabilities of the objects (Modelling, Analysis);

d. Modelling of the communication relationships (Modelling, Subject Matter Expert); and

e. Modelling of the effect and interaction relationships (Modelling, Subject Matter Expert).

3.3.3. Documentation to be Prepared

a. Conceptual Model of Entities, Units, Objects and Capabilities.

b. Communication and Interaction Relationships.

c. Data Recording and Management Plan:

(1) Measuring Values and Measuring Points.

3.3.4. Products to be Prepared and Additional Documentation

a. Conceptual Model of Entities, Units, Objects and Capabilities.

3.4. ANALYSIS OF REALISATION TYPES

3.4.1. Description

1. The Analysis of Realisation Types serves to assign a specific realisation type to the defined entities, units and objects on the basis of their respective capability

descriptions and the purpose of the exercise. The aim here is not yet to select specific systems. It is rather to determine whether an entity, unit or object is to be realized in the exercise as:

a. Simulation System (SimSys);

b. Real System (RealSys);

c. Services (e.g. Terrain Database Services); and

d. Role Play.

2. Besides determining the type(s) of realisation, an initial decision regarding the time pattern for the exercise has to be made in the course of this step. Regarding the time patterns there are generally two possibilities: if Real Systems are involved that have to be operated, the exercise will take place in real time. If this is not the case, an agreement on an uniform simulation time to be used for this exercise will be necessary.

3.4.2. Activities

a. Analysis of those parts of the Conceptual Model that have already been prepared (Modelling);

b. Analysis of inevitable limitations regarding the selection that result from the existing framework conditions (Modelling, OCE);

c. Determination of the realisation types (Modelling);

d. Analysis of the time pattern valid for the entities, units and objects involved in the scenario with a view to the selected realisation type (Modelling); and

e. Determination of the time pattern for the exercise (Modelling).

3.4.3. Documentation to be Prepared

a. Conceptual Model:

(1) Realisation Type.

3.4.4. Products to be Prepared and Additional Documentation

Conceptual Model – If an existing formal Conceptual Model is being used, it needs to be adjusted to the determinations that have been elaborated in this process.

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CHAPTER 4 MODULE 3 SYSTEM DEPENDENT PLANNING

4.1. PURPOSE

The purpose of this module is to identify an appropriate technical basis for the assumed objectives and conditions of the exercise, and to verify whether the selected solutions will meet all the requirements identified.

4.2. APPROACH

As this process is linking the operational needs of the exercise with technical capabilities, it requires a proper dialogue between the operational planning community and the technical community. While most of the technical analysis and decisions will be made by technical experts (shielding the operational planners from underlying technical complexity) understanding of the high-level concepts of the technical side is important to ensure effective information exchange between the two cooperating communities. The aim is to keep the technical vocabulary and descriptions as abstract enough as to the level that makes the operational planner comfortable, allowing them to express their requirements towards the technical experts without excessive burden of technical details, while maintaining sufficient understanding of the output provided in return.

4.3. PROCESS

1. The three steps composing this module:

   a. Analysis-based selection of current systems for the simulation environment;

   b. Detailed design of the simulation environment; and

   c. Feasibility check – technical and risk assessment.

2. In case the feasibility check identifies shortcomings of the approach taken, steps 1 and 2 may be reiterated as appropriate. The following diagram depicts this process.

3. The work done in the preceding modules has well-defined entities, units and objectives participating in the scenario, their essential properties and relationships expressed in operational terms. The decision as to which of the entries are to be simulated has been made as well. The next steps are to choose capable systems to simulate the selected entities, units and objectives and to assure that their communication and other interactions can be modelled as required. This is the moment when the technical community will take over and translate the operational interactions into technically well-defined data exchange model and will find out which systems/tools will meet the purpose. The proposed technical model will then be checked against the original objectives and requirements to verify that they are all properly reflected by the selected data exchange model.

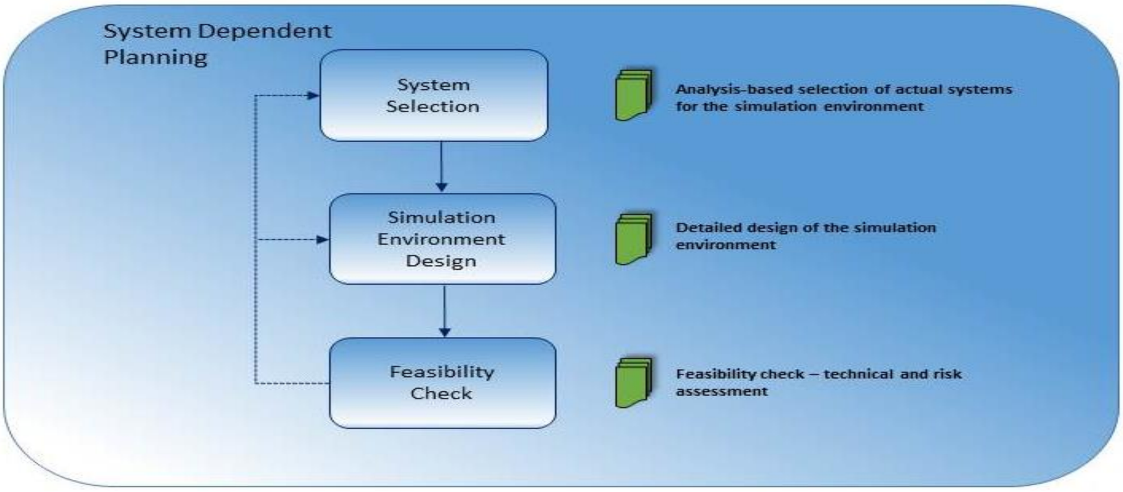

Figure 4-1: Module 3: System Dependent Planning Process.

4.4. SYSTEM SELECTION AND ARCHITECTURE SELECTION

4.4.1. Description

1. Analysis performed so far (referred to as capability analysis) is assumed to have identified the involved entities, units and objectives, their basic characteristics and capabilities, and requirements regarding interactions between those (communication requirements, attrition effects etc.) This set of information forms the basis for the technical experts to analyse potentially available systems capable of implementing the required entities, units and their relationships. It is important that the operational planners pass this information properly documented to the modelling specialists.

2. The modelling specialists, based on that information, will identify any available system in their portfolio, which can be used to model all the entities, units, objectives and relationships as required. However, this will not result yet in a single particular solution being recommended for the job. At this stage it can happen that multiple systems capable of supporting the task are found, and all of them should be kept on the list of candidates until further analysis balances pros and cons of particular systems, based on specifics of the implementation context and any additional constraints that may be identified.

3. While representation of identities, attributes, and interactions will have been addressed that way, the next thing is to look at is the granularity of expected gaming and the level of detail needed for various events across the operational scenario. Analysis of those will typically further narrow down the selection of suitable systems.

4. Since inter-system networking is a vital part of the technical solution to be proposed, considerations of available connectivity options will also be done at this point.

Without going into technical detail, this will lead to a pre-selection of high-level protocols[1] applicable to the solution. That, in turn, will also imply a selection of any connectivity middleware[2] and other supporting systems.

5. Another aspect addressed in this step is the determination of measuring methods for all performance measuring values that are to be recorded as per the requirements documented in the preceding modules. The reason for this is that understanding of how those values have to be measured may imply narrowing down the selection of supporting systems.

4.4.2. Documentation to be Prepared

a. List of selected systems, together with justification (selection criteria and rationale); and

b. Methods of recording all the required performance measuring values.

4.5. SIMULATION ENVIRONMENT PREPARATION

4.5.1. Description

1. The simulation systems, modelling weapon systems and components selected in the previous step must be integrated to generate a comprehensive simulation environment for the intended purpose. The operational concepts of the entities, units, objectives, their characteristics, capabilities, and interactions will be implemented in this simulation environment by means of technical concepts – in formal terms such as object model, interaction model and state model. These concepts have to be refined now, to the level of accuracy required by the underlying technical data structures and protocols. This must be done in close cooperation between the operational planners and the providers of technical solutions in order to allow the latter to meet the setup pre-requisites of particular (e.g. weapon-) systems, while keeping operational qualities and quantities accurately reflected. This includes:

a. Mapping the entities, units and objects to simulation object classes; this means, required capabilities of the units must find their corresponding object attributes.

b. Translation of entity and unit communication requirements to appropriate interfaces between entities, units and weapon systems. This defines which (e.g. weapon-) system exchanges data during run time and exactly what data. In other words, full formalisation of the communication is done here.

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1 Such as High Level Architecture (HLA) or Distributed Interactive Simulation (DIS), they are examples of simulation-oriented connectivity methods.

2 Such as Run-Time Infrastructure (RTI), which implements, among others, HLA federation principles.

c. If the operational requirements describe different states of units/entities, those states have to be reflected in the technical model as well. For example, the damage level of a unit or change of capability, for example, an aircraft: flying versus landed.

2. Another important aspect to be paid attention is the time management. It addresses a number of issues:

a. Decision on whether the simulation will be executed in real time or not;

b. In case multiple simulations will run simultaneously and interconnected, a master-clock needs to be determined, e.g. choosing for reference time the clock of one system or the clock of the GPS-signal;

c. Impact of inter-system latency must be analysed; and

d. If timely periods in a scenario are to run faster than real time (accelerated execution of some time periods, e.g. to have a look-ahead view of the consequences of some decisions, or to quickly bring the simulation to the current state after restoring a checkpoint), time-related behaviour of all the integrated systems shall be well observed.

3. Once all these pieces of information have been refined and clarified, the technical community will perform (possibly automated) consistency checks and will encode the results in the data of the simulation system. However, some of the facts and decisions made in the process may not have a direct translation to the data of simulation system. Examples of such information are:

a. Security procedures;

b. Time management arrangements, including synchronization points; and

c. Procedures to store data.

4. It is important that this remaining information stays documented and maintained along with the simulation system data, to ensure consistency across all the involved systems.

5. In parallel, determining the technical architecture of the simulation environment and its basic characteristics is necessary to provide a comprehensive set of data for the next step. One of the key purposes will be determining the number of necessary operators which directly translates into the number of simulation control workstations and its associated amount of network traffic. In order to enable the proper determination of that number, another set of information pieces must be passed to the technical designers:

a. EXCON structure. Derived from overall exercise analysis, this identifies all the control roles (persons) involved in the exercise. Some of those will require close support of the simulation and they need to be identified at this point.

b. Identification of the scenario parts to be run in the simulation. The scenario analysis will give an approximate number and the degree of complexity of the events and the number of simulated entities involved. Combined with an average processing capability of a simulation operator, it will give an estimate head/workstation count which will be taken into account in the final design. A more accurate number can be obtained by analysing which logically different parts, if any, can be run by the same operator, and which of them have to be assigned to different operators because of the information flow constraints implied by the exercise pattern.

4.5.2. Documentation to be Prepared

a. Detailed design of the intended simulation environment, including all the technical components and their above-discussed parameters.

4.6. FEASIBILITY CHECK

4.6.1. Description

1. After setting up of the simulation environment design in the previous step, make sure that the design properly reflects all the requirements known so far, and that it can be implemented into physical systems. This activity requires cooperation of the operational and the technical planners.

2. The first action is to go back to the objectives and requirements which have driven the process of designing the simulation environment. Now, it needs to be verified that none of them have been omitted and that the technical solution being developed will achieve each objective or requirement. Should that be the case, the looping path of the module must be entered and, depending on the issue detected, Steps 2 and 3 or 1, 2 and 3 must be re-executed to correct the shortcoming. This has to be repeated until the design properly addresses all the requirements.

3. The second check to be done here is a look-ahead towards the actual implementation of the design. There are a number of issues which can be potentially detected here:

a. Obstacles of technical nature which make the implementation unfeasible;

b. Cost issues; and

c. Any risks associated with performing the implementation.

4. All of the above should be carefully analysed at this point. If any of those issues turn out to be a threat to the process, the requirements list should be extended with recommendations on how to solve or to avoid them. Then, again, re-execution of steps 2 and 3 or 1, 2 and 3 should be done to take the newly detected constraints into account.

5. It should be documented and explained how to proof the exercise is fully supported by the architectures and by the federation of simulations.

4.6.2. Products to be Prepared and Additional Documentation

a. Following the successful completion of this step, the final result is a “safe to implement” stamp on the simulation environment design, along with an updated list of requirements taking the detected constraints into account.

CHAPTER 5 MODULE 4: EXECUTION PREPARATION

1. The Execution Preparation Module (Figure 5-1) of the Planning and Product Development stage (Bi-SC Directive 75-3) explains how to accomplish all preparations necessary for executing the exercise, including distributed simulation. This includes the adaptation, if necessary, of the components to the aim and training objectives of the exercise, the planning and configuration of the network in which the exercise is supposed to take place and the planning of the actual execution.

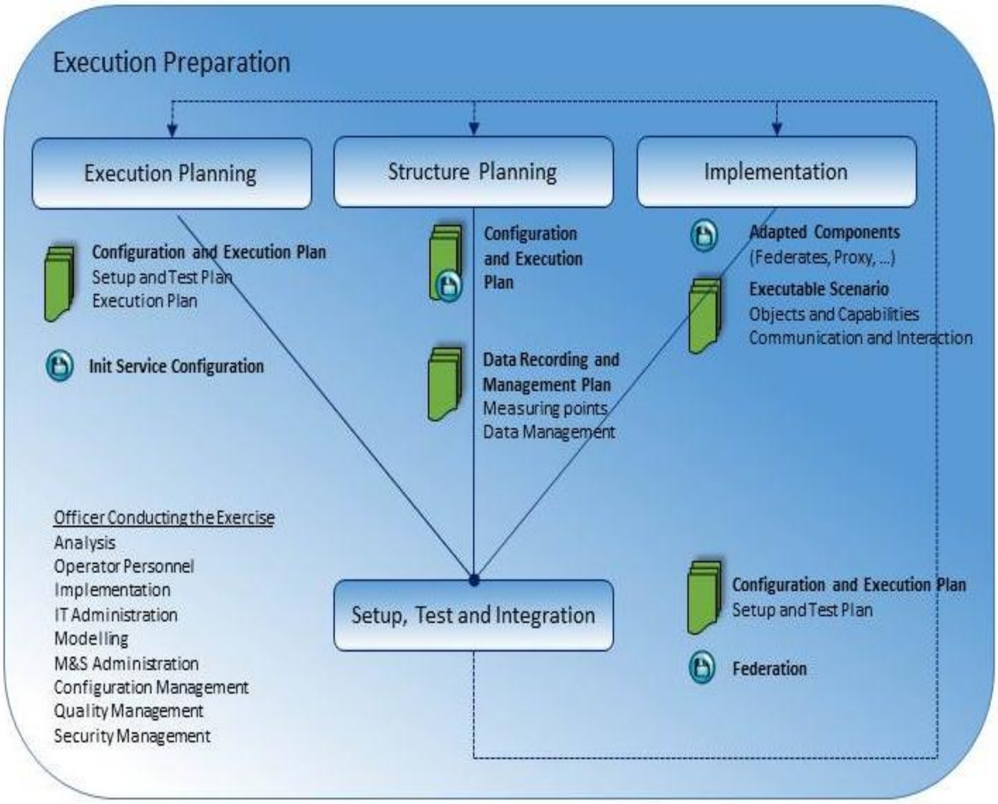

Figure 5-1: Module 4: Execution Preparation.

2. In addition, the federation of the involved training systems is to be set up and the integration is tested step-by-step at this point. This requires an iterative approach, until the inadequacies are identified and eliminated before the integration can go on.

5.1. EXECUTION PLANNING

5.1.1. Description

1. The OCE uses the Execution Planning step to plan the execution of the exercise. The time-related framework conditions and technical restrictions such as the sequence of the system start of the systems involved have to be taken into account.

2. In this context, it should be mentioned that an exercise can contain a basic conceptual scenario with different variants, which requires rearrangements between the simulation runs. All simulation runs have to be defined unambiguously during this step. This includes the exact determination of all variable values and the determination of the number of repetitions.

3. The Analysis and Quality Management roles provide inputs during this step, in the form of advices as necessary to ensure that sufficient data is produced, to be able to get a robust conclusion from the measurements. This is guaranteed by determination of the values of the different simulation runs at this point.

5.1.2. Activities

a. Analysis of the scenarios (OCE);

b. Determination of the operators' actions within the conceptual scenario (OCE, Analysis, Operator Personnel);

c. Analysis of the technical requirements (OCE, Modelling, Configuration management, M&S-Administration);

d. Analysis of Goals and Requirements of the Exercise (OCE, Analysis, Modelling);

e. Refinement of the planning with a view to the necessary number of simulation runs to ensure that valid results can be obtained (Analysis, Quality Management);

f. Analysis of time-related guidelines / requirements (OCE);

g. Determination of the Schedule (OCE);

h. Planning of the execution (OCE); and

i. Preparation of the Flow Chart (OCE).

5.1.3. Documentation to be Prepared

a. Configuration and Execution Plan:

(1) Setup & Test Plan; and

(2) Execution Plan.

5.1.4. Products to be Prepared and Additional Documentation

Configuration file for Init (initialisation) Service – If an Init Service is used for distributing the entry data and starting the simulation run, appropriate configuration files have to be produced. A common standard for this purpose does not exist so far.

5.2. STRUCTURE PLANNING

5.2.1. Description

1. Structure Planning comprises all activities of the technical planning of an exercise. Most importantly, this includes the planning and determination of the network in which the distributed simulation is supposed to take place.

2. The task here, besides determining the network structure, is to identify and distribute the IP addresses and to store and provide these data to be jointly available on a central medium. During the planning process it is important to pay attention to the bandwidths and data rates used in this network. This may require requesting the necessary resources. An important task here besides network planning is to consider all configurations of the SimSys, RealSys and Services involved. This explicitly includes the configurations of the network components used (e.g. switches, routers, RTIs).

5.2.2. Activities

a. Determination of the network structure (M&S-Administration);

b. Identifying and requesting the necessary network resources (M&S-Administration, Modelling, Implementation);

c. Providing a medium for jointly used data (M&S-Administration);

d. Drawing up the Configuration Plan (M&S-Administration); and

e. Determining the measuring points (M&S-Administration, Modelling).

5.2.3. Documentation to be Prepared

a. Configuration and Execution Plan:

(1) Configuration Plan.

b. Data Recording and Management Plan:

(1) Measuring Values and Measuring Points; and

(2) Data Management.

5.2.4. Products to be Prepared and Additional Documentation

Configuration Plan – The Configuration Plan (in contrast to the documentation) covers all configuration files of the systems involved.

5.3. IMPLEMENTATION

5.3.1. Description

In the step Implementation separate components (Federates, Proxy, Services) are adapted to the aim and requirements of the exercise and technical environmental conditions and interfaces are created as required. If during the Systems Selection no system has been found that meets the requirements or isn't suitable to be part of a distributed simulation, the task is to develop such a system, now. Since the cost and time requirements are likely to increase enormously as a result of such a decision, it has to be reviewed whether it is still possible to use the pre-determined framework.

5.3.2. Activities

a. Adaptation of existing components (Configuration management);

b. Adaptation or implementation of interfaces needed (Configuration management); and

c. Development of new components (Modelling, Configuration management).

5.3.3. Documentation to be Prepared

a. Configuration and Execution Plan:

(1) Configuration Plan.

5.3.4. Products to be Prepared and Additional Documentation

Adapted components – All changes (adaptations) to components (Federates, Proxy, Services) have to be documented. If the components are administered separately, e.g. in a Model-Management-System (MMS), adherence to the respective processes for problem and modification management is necessary.

5.4. SET UP, TEST AND INTEGRATION

5.4.1. Description

1. The last step in the Execution Preparation Phase is Setup, Test and Integration of the distributed simulation. It covers the setup and networking of the federates (various training and real interaction systems in a federation).

2. The federation is now integrated and the correct functioning of all federates is now verified by means of functional tests. The focus should be on ensuring that all requirements laid down in the Federation Agreements are adhered to. This is followed by integration tests that are used to verify the proper interaction of the federates. This is a point where, in addition to problems in the aspect of data exchange, technical difficulties, e.g. regarding compatibility, may arise.

3. Scenario tests should also be conducted during this step. That is to verify the correct run of the scenario. Although at this point it will not always be possible to draw conclusions on the quality of simulation runs to be carried out later, obvious shortcomings such as deviations from waypoints within the executable scenario can be identified.

4. Finally, the tested federation should be checked on the identified VV&A-relevant aspects. After all these tests, it is possible that shortcomings emerge which make it necessary to go back to an earlier phase.

5.4.2. Activities

a. Setup of the federates (Modelling & Simulation Administration);

b. Networking of the federates (IT Administration, M&S Administration);

c. Establishing operational readiness of the federations (IT Administration, M&S Administration);

d. Functional tests (Analysis, Operator Personnel);

e. Integration tests (Analysis, Operator Personnel);

f. Scenario tests (Analysis, Operator Personnel); and

g. Check of potential VV&A-relevant aspects (Analysis).

5.4.3. Documentation to be Prepared

a. Configuration and Execution Plan:

(1) Configuration Plan.

5.4.4. Products to be Prepared and Additional Documentation

a. Federation, determined architecture.

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CHAPTER 6 MODULE 5: EXECUTION

In the Execution module (Figure 6-1) of the Operational Conduct stage (Bi-SC Directive 75-3), the simulation is conducted according to the Flow Chart. Adjustments are possible after a few separate simulation runs as laid down in specified rearrangement plans. During the simulation runs all predefined measuring values and data are to be recorded in a data archive.

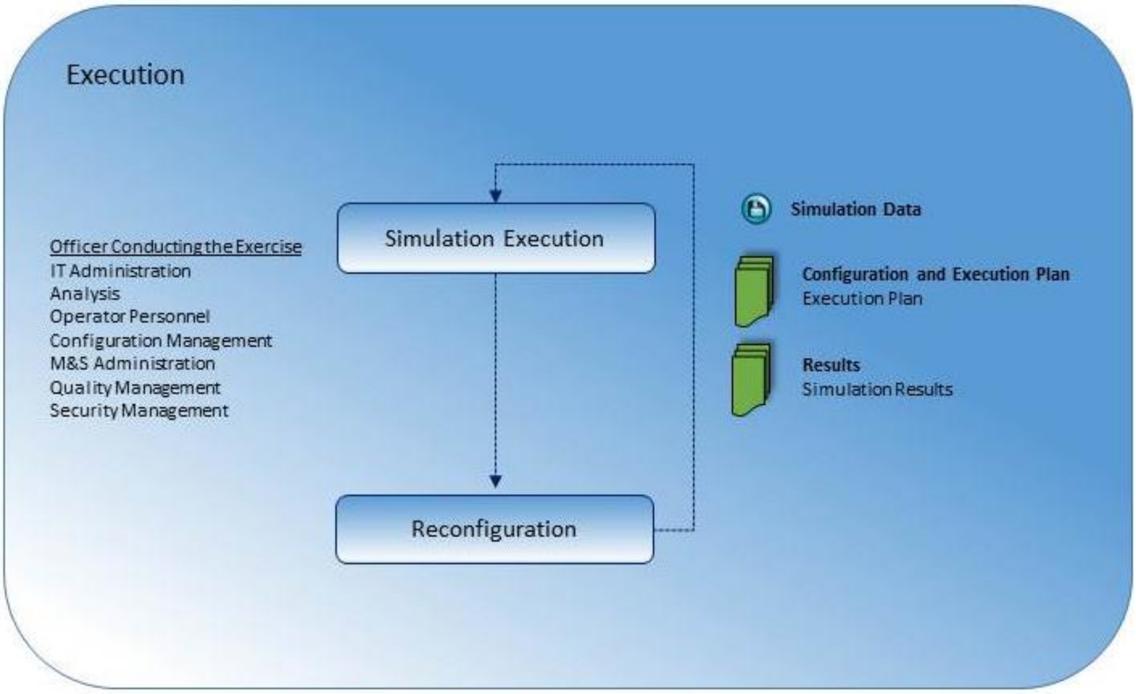

Figure 6-1: Module 5: Execution.

6.1. SIMULATION EXECUTION

6.1.1. Description

The step Simulation Execution covers the actual Simulation run. It is the task of the Analysis role to monitor the execution of the simulation runs and to record the data being generated. In doing so, Analysis should focus on the data that are critical for the quality of the results, for example, the latency times between the systems. If these times exceed a pre-defined value, the results may be usable to a limited extent only. Coordination of the simulation execution is the responsibility of the Exercise Director.

6.1.2. Activities

a. Execution of the simulation runs (Operator Personnel);

b. Recording of the simulation data (Analysis); and

c. Monitoring of critical parameters (Analysis).

6.1.3. Documentation to be Prepared

a. Configuration and Execution Plan; and

b. Results: Simulation Results.

6.1.4. Products to be Prepared and Additional Documentation

Simulation Data – The Simulation data is the primary, raw data record of the systems involved (SimSys, RealSys, Services) during a simulation run.

6.2. RECONFIGURATION

6.2.1. Description

After a simulation run it may be necessary, to perform a Reconfiguration. This may be the reconfiguration of the simulation environment for the follow-on simulation run or even completely rebuilding it, for example, in order to incorporate a new federate into the system … given that the new simulation environment has already been tested in the course of the step Setup, Test and Integration. This helps at this point to avoid the need to go back to earlier phases. Pre-test is particularly important when real systems are involved, which in many cases are only available for a limited time.

6.2.2. Activities

a. Dismantling federates that are no longer needed (M&S Administration);

b. Setting up federates needed for the next run (M&S Administration); and

c. Establishing operational readiness of the federation (IT Administration, M&S Administration).

6.2.3. Documentation to be Prepared

a. None.

6.2.4. Products to be Prepared and Additional Documentation

a. None.

CHAPTER 7 MODULE 6: ANALYSIS

1. The module “Analysis” provides support in selecting suitable verification and acceptance criteria in the initial exercise phase. It checks the determined architecture with regard to its functioning and the acceptance criteria. In addition, it determines what data should be monitored during the simulation runs.

2. On completion of the Computer Assisted Exercise, the collected data can be analysed, now. This is done in three steps:

a. Data Preparation;

b. Plausibility Check; and

c. Analysis and Interpretation.

3. First of all, the data has to be processed before a plausibility check is done. This is to ensure that only quality data is included in the ensuing evaluation and interpretation process.

4. The data collection provides the material to support the analysis, assessments and evaluations in order to generate the deliverables and it is the first important step that must be accomplished. The capturing of lessons learned during and after the Exercise is also essential to ensure that findings are shared for use in future operations and exercises.

5. In order to achieve a better Data Collection Management during the execution phase it is recommended to use appropriate CAX support tools that are able to record the data flow on the network(s).

6. Further Data Collection Means have to be used to document also non-technical values that are considered to be important to achieve the overall Exercise aim(s) and Training Objective(s).

7. These tools should assist in the observation, data collection and data analysis of the Training Audience and the simulation’s technical performances and to support the different evaluation processes.

8. These tools should be able to:

a. Help to achieve the Exercise’s aim, objectives and analysis requirements. Furthermore, to cover mission essential tasks, forces, standards and essential operational capabilities to assist analyses and generation of reports on completion of the Exercise.

b. Identify deficiencies that could impede training audience abilities in performing their assigned missions.

c. Support in conducting comprehensive post-exercise analysis that can reconstruct events and derive lessons learned applicable for users in real-world scenarios.

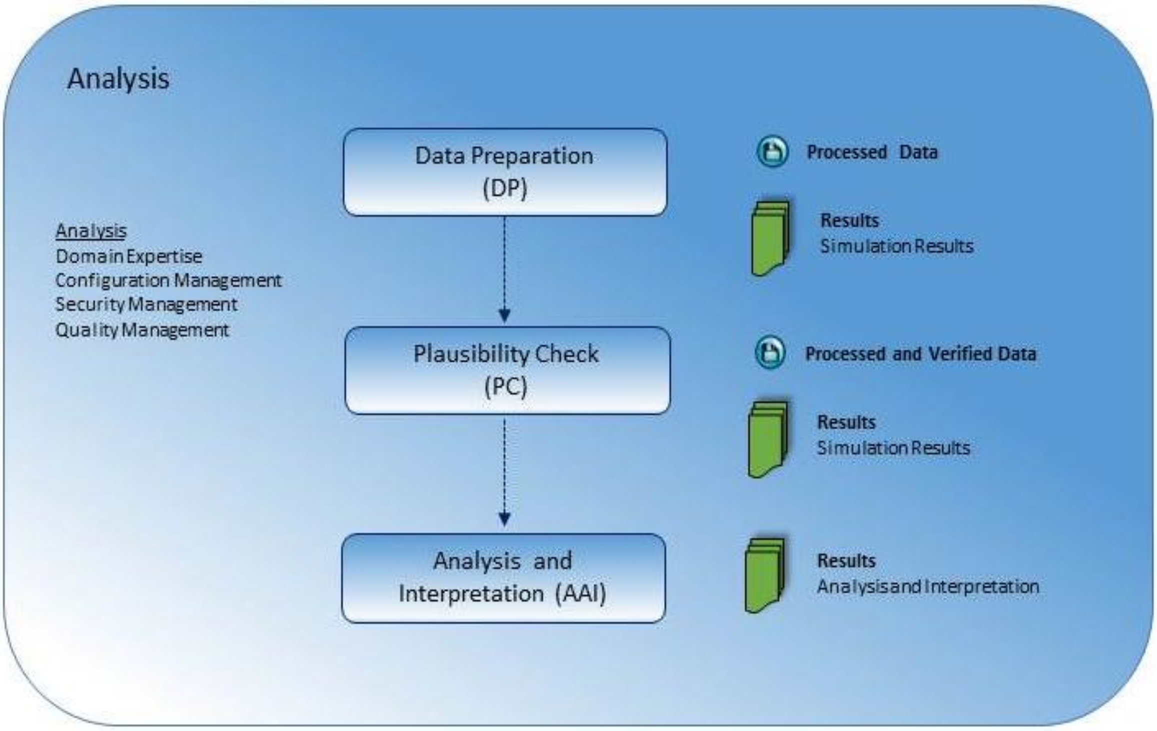

Figure 7-1: Module 6: Analysis.

7.1. DATA PREPARATION (DP)

7.1.1. Description

1. After all data have been recorded in the course of the Exercise, it is now necessary to condense these Simulation data in the step Data Preparation (DP). Until to this step, the Analysis role should make use of the techniques of data fusion and data reduction. This is to reduce the volume of recorded data so that it can be well handled in the next processing step.

2. A variety of data collection methods may be used for the analysis, experimentation, assessment and evaluation team(s) needs. The methods to be used and the requirements for accessing any of these data types should be defined beforehand in the Data Recording and Analysis Plan (DRAP) (e.g. as Annex to Exercise Plan).

3. The collection of observations and data during the Exercise will be conducted in accordance with procedures laid down in the DRAP.

4. The DRAP should include aside from technical recordings also the following:

a. Command's lessons learned programs;

b. Decision briefings;

c. Command battle logs;

d. Command diaries; and

e. Etc.

5. This activity is also described in DSEEP (*IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process (DSEEP)*. 2011. – IEEE Std 1730-2010).

7.1.2. Activities

a. Data collection (Analysis);

b. Data fusion (Analysis); and

c. Data reduction (Analysis).

7.1.3. Documentation to be Prepared

a. Simulation Results.

Remarks:

a. References to the simulation data collected have to be defined; and

b. The simulation data has to be designated unambiguously so that identification on the basis of the references is possible without any doubts.

7.1.4. Products to be Prepared and Additional Documentation

Processed Data – The DRAP should explain how the recorded data has been prepared for the analysis process. These preparation tools will most probably be very specific to each type of data and the purpose of the analysis.

7.2. PLAUSIBILITY CHECK (PC)

7.2.1. Description

1. The aim of the Plausibility Check (PC) is to evaluate whether the processed data is usable and suitable for analysis and interpretation. This means, to determine whether interaction dependencies have been implemented correctly in the simulation. This provides the opportunity to identify obvious shortcomings of standards at an early time. This step should be conducted with the help of analysis tools and the use of experience and knowledge gained in previous Exercises.

2. Examples of plausibility checks:

   a. Ensuring that number of hits is less or equal to number of rounds fired; and

   b. Checking that there are no units outside certain geographical areas.

7.2.2. Activities

   a. Creating logic correlations between data (Analysis);

   b. Verification of logic correctness (Analysis); and

   c. Selection of correct data (Analysis).

7.2.3. Documentation to be Prepared

Simulation Results – Documentation of Data Preparation activities and the performed checks on the collected and the processed data and the corrected/augmented data (if any) must be indicated.

7.2.4. Products to be Prepared and Additional Documentation

Processed and Verified Data – The term "processed and verified data" refers to data that has already been subjected to a plausibility and quality check.

7.3. ANALYSIS AND INTERPRETATION (AAI)

7.3.1. Description

1. Now that it has been assured that the recorded data does not contain obvious mistakes the next step is the "Analysis and Interpretation" (AAI). This means that the processed and verified data is used with regard to the aims of the Exercise. For this purpose, Analysis cooperates with Domain Expertise in selecting the results that are usable for evaluation by the OCE. These results are brought into an adequate form for presentation to the OCE.

2. Once the results are available, a certification by Quality Management can be issued, if required / applicable. The evaluations, analyses and assessments will be conducted in accordance with and within the timeframes specified in the DRAP. The depth and breadth of the evaluations and analyses are also defined by the DRAP.

7.3.2. Activities

a. Evaluation of the data (Analysis, Domain Expertise);

b. Interpretation of the data (Analysis, Domain Expertise);

c. Preparation of the data, i.e. translating the results into an adequate form for presentation (Analysis, Domain Expertise); and

d. Certification (Quality Management).

7.3.3. Documentation to be Prepared

1. Evaluation and Interpretation – The processed and verified data has to be evaluated with regard to the DRAP requirements. The evaluations required (diagrams, characteristics data etc.) have to be prepared.

2. Remarks:

a. In this Module no detailed documentation guidance is given concerning evaluation and interpretation, since the evaluation and interpretation has to be defined per each Exercise by implementing a DRAP; and

b. Each target value and requirement should be addressed by the DRAP.

3. **Achievement of the aims**: At this stage it is the task of the OCE to judge whether the Exercise has achieved the aims, objectives and requirements defined in the Requirements Specification (RS).

4. Remarks:

a. This module provides no detailed documentation guidance, as this depends too much on the individual Exercise; and

b. This documentation should also include an effort/benefit analysis.

7.3.4. Products to be Prepared and Additional Documentation

a. None.

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CHAPTER 8 MODULE 7: FOLLOW-UP

This is the final phase, after the data has been evaluated and the results have been presented to the OSE/OCE. The latter prepares an assessment of the Exercise based on the DRAP results and the operational assessment. All these assessments include the initially defined Aims and Requirements and their documentation. The lessons learned are to be archived and all reusable components are to be stored in a data base (e.g. a Model Management System or a Scenario Data Base). The Exercise ends with compiling the final reports.

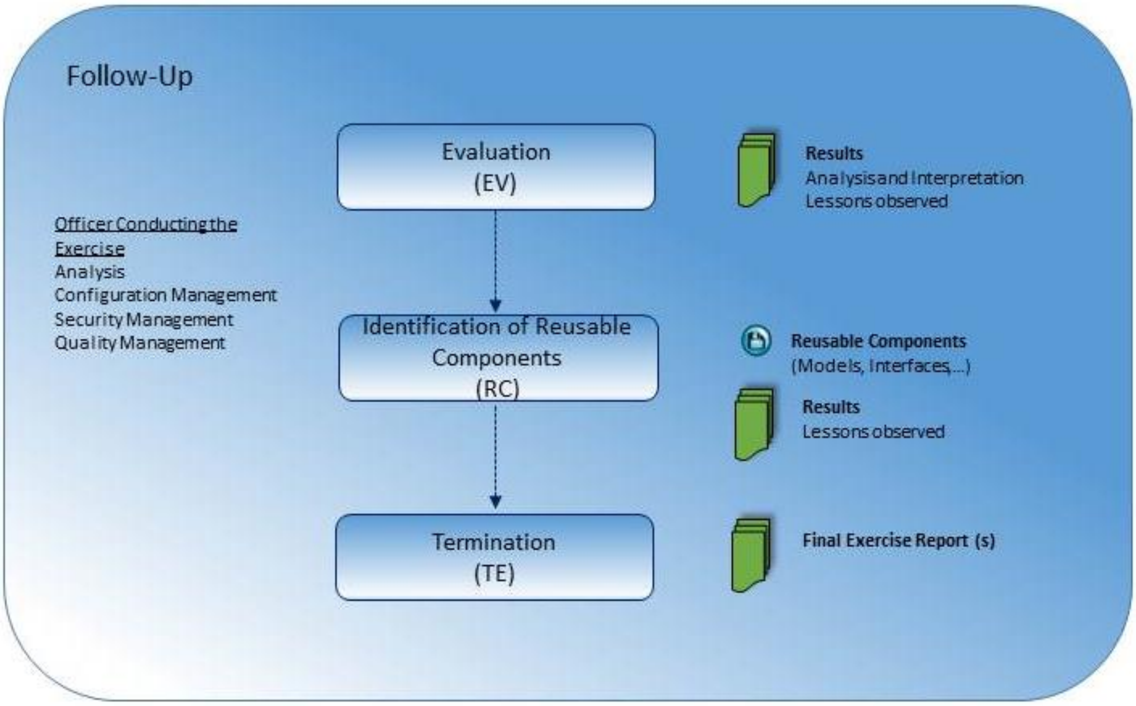

Figure 8-1: Module 7: Follow-Up.

8.1. EVALUATION (EV)

8.1.1. Description

1. During the Module “Evaluation” (EV) the OCE conducts an evaluation of the Exercise based on the results out of the previous module.

2. The assessment includes:

   a. Achievement of the aim(s); and

   b. Compliance with the quality requirements.

3. This allows conclusions regarding the questions whether:

   a. The aim(s) of the Exercise have been achieved;

   b. Further training is necessary;

   c. What approach should be selected for further Exercises; and

   d. How to handle VV&A issues.

4. The findings on these issues should be kept available for future distributed simulations as Lessons Learned. This can help to avoid repetition of mistakes once made.

8.1.2. Activities

   a. Evaluation of the results (OCE);

   b. Assessment of the Exercise (OCE); and

   c. Storage of the lessons learned (OCE, Configuration Management).

8.1.3. Documentation to be Prepared

1. Evaluation and Interpretation – The processed and verified data has to be evaluated with regard to the DRAP requirements. The required evaluations (diagrams, characteristics data etc.) have to be prepared.

2. Remarks:

   a. In this Module no detailed documentation guidance is given concerning evaluation and interpretation, since the evaluation and interpretation has to be defined per each Exercise by implementing a DRAP; and

   b. Each target value and requirement should be addressed within the DRAP.

3. Achievement of the aims – At this point it is the task of the OCE to judge whether the Exercise has achieved the aims, objectives and requirements defined in the Requirements Specification (RS).

4. Remarks:

   a. This module provides no detailed documentation or guidance, as this depends too much on the individual Exercise; and

   b. This documentation should also include an effort/benefit analysis.

5. Lessons learned – Identified problems and their solutions: the purpose is to list the identified problems in the course of the Exercise. If possible, solutions should be described, too.

6. Remark:

   a. A Fair Fight questionnaire should be applied (for the purposes of categorization and uniform problem description).

7. Proposals for improvement and advice for future Exercises – The purpose is to document improvement proposals, and provide advice for future Exercises.

8.2. IDENTIFICATION OF REUSABLE COMPONENTS (RC)

8.2.1. Description

In the step “Identification of Reusable Components” (RC), the components created or adapted in the course of the Exercise, should be identified for possible reuse. As an example, identified reusable models may be archived in an MMS. This will allow faster system-dependent planning for future Exercises. The same applies to the different types of scenarios if archived in e.g. a scenario database.

8.2.2. Activities

   a. Archiving of reusable models (Configuration Management);

   b. Archiving of the scenarios : country book, operational, conceptual and executable scenarios (Configuration Management); and

   c. Archiving of other reusable components (Configuration Management).

1. Reusable components – The purpose is to identify and describe all reusable components of the Exercise.

2. This includes:

   a. Models;

   b. SimSys and Services;

   c. Interfaces and proxies adapted;

   d. Configurations (e.g. Network configuration, C2-Configuration, etc.);

   e. Data (objects, entities, attributes, units, capabilities, communication, terrain database, interaction, realisation type, etc.);

   f. Scenario;

   g. Storyline;

   h. MEL/MIL (Main Event List/Main Incident List); and

   i. Etc.

3. The following information should be stated for each component:

a. Description of the component (with indication of exact version).

b. Short description of the potential reusability.

c. Where is the component available?

d. Where is information on the component available?

e. Who is POC/custodian for the component?

8.2.3. Products to be Prepared and Additional Documentation

Reusable Components – The task here is to identify RC and to archive them in a usable way.

8.3. TERMINATION (TE)

8.3.1. Description

1. When all other activities have been completed, the step Termination (TE) finalises the Exercise.

2. Since an Exercise can be regarded from different vantage points (e.g. technology, project management), it is common to generate separate Final Reports for each specialized field of activity (in annex to the OCE's Final Exercise Report).

3. Specific Final Reports may be required in accordance to different organizational demands. The depth and breadth of the evaluations and analyses are also defined by the DRAP.

8.3.2. Activities

a. Compile the Final Reports (OCE).

8.3.3. Documentation to be Prepared

a. None.

8.3.4. Products to be Prepared and Additional Documentation

1. Final reports – As a rule, Final Reports are subject to external rules and guidelines and this is why this document does not contain any guidance regarding structure and contents of these final reports.

2. However, as a general remark, relevant observations in the field of simulation services with regard to the achievement of the Exercise Aim and Training Objectives should be addressed.

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CHAPTER 9 CONCLUSION

1. Take this Handbook as guidance rather than dogma!

2. The most important recommendation for the application of this Handbook is to regard it as guidance and aid – by no means as a dogma “carved in stone”. In this sense the Handbook provides a framework for planning, executing and documenting a distributed CAX using simulation. The actual application (e.g. with respect to role assignment or scope and detail of the documentation) always depends on the specific circumstances of the individual CAX and has to be tailored by the person in charge.

3. Thinking is important, not documentation!

4. This Handbook should be a living document in the sense that experience from practical applications should continuously be taken into consideration and incorporated. This is especially relevant for:

   a. Proposed changes;

   b. Improvements;

   c. Clarifications; and

   d. Additions.

5. Every feedback is highly welcomed and contributes to enhancing the quality and applicability of this Handbook, which, in the end, will lead to a high degree of acceptance and utilization on a routine basis.

6. Please send your feedback to your NMSG/MORS national representative.

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ANNEX A LIST OF ACRONYMS

AAI	Analysis And Interpretation
AMSP	Allied Modelling & Simulation Publication
Bi-SC	Bi Strategic Command
C2	Command & Control
CAX	Computer Assisted Exercise
DEU	Germany
DIS	Distributed Interactive Simulation
DP	Data Preparation
DRAP	Data Recording and Analysis Plan
DSEEP	Distributed Simulation Engineering and Execution Process
DTE	Distributed Training & Exercise
EV	Evaluation
EXCON	Exercise Control
FOM	Federation Object Model
GMF	German Maritime Federation
HLA	High Level Architecture
ICI	Istanbul Cooperation Initiative
IEEE	Institute of Electrical and Electronics Engineers
IT	Information Technology
LTUAF	Lithuanian Air Force
M&S	Modelling and Simulation
MD	Mediterranean Dialogue
MEL/MIL	Main Event List / Main Incident List
MMS	Model Management System
MORS	Military Operational Requirements Subgroup
MSG	Modelling and Simulation Group
NATO	North Atlantic Treaty Organization
NETN	NATO Exercise and Training Network
NetOpFueEXER	verNETzte OPerationsFUEhrung (English – Networked Operation Management) EXERcise
NSO	NATO Standardization Office
OCE	Officer Conducting the Exercise
OSE	Officer Scheduling the Exercise
PC	Plausibility Check
PfP	Partnership for Peace (NATO)
POC	Point Of Contact
RC	Reusable Components
RealSys	Real System
RS	Requirements Specification
RTI	Run-Time Infrastructure
SimSys	Simulation System

SME	Subject Matter Expert
STANREC	Standardization Recommendation (NATO)
Std	Standard
SWE	Sweden
TE	Termination
VEVA	Vorgehensmodell für den Einsatz der VIntEL-Architektur (English – Procedure Model for Application of the VIntEL-Architecture)
VIntEL	Verteilte Integrierte Erprobungs-Landschaft (English – Distributed Integrated Test Bed)
VV&A	Verification, Validation and Accreditation

ANNEX B LIST OF FIGURES AND TABLES

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